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MILACRON

Process Controls Division
Lebanon, Ohio 45036

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**A
POCKET
GUIDE
TO THE
CIP/2100**

NOVEMBER 1970



Process Controls Division | Cincinnati Milacron Company
Lebanon, Ohio 45036 | Tel. (513) 494-1200

**Machine Tools
Process Controls
Chemicals
Plastics
Plastics Processing Machinery
Abrasives**



INSTRUCTION SET

Operation Code	Definition	Hexadecimal Operation Code
ADA	Add to A	A0
ADV	Add Variable to A or AB	A8
ALA	Arithmetic Shift Left A	28
ALB	Arithmetic Shift Left B	29
ALL	Arithmetic Shift Long	2A
ANA	And A	D0
ANV	ANV Variable to A	D8
ARA	Arithmetic Shift Right A	2C
ARB	Arithmetic Shift Right B	2D
ARL	Arithmetic Shift Right Long	2E
AWX	Add Word Length to X	46
CPA	Compare A	C0
CPV	Compare Variable to A	C8
DCX	Decrement X by 1	45
DIN	Disable Interrupt System	04
DIV	Divide	98
DRT	Disable Real Time Clock	06
DWM	Decrement Word in Memory by 1	78
EIN	Enable Interrupt System	05
ERT	Enable Real Time Clock	07
ESW	Enter Sense Switches	02
HLT	Halt	00
IBA	Input Byte to A	31
IBB	Input Byte to B	32
IBM	Input Byte to Memory	33
IBS	Input Byte Serially	30
INA	Increment A by 1	48
INB	Increment B by 1	49
INX	Increment X by 1	44
IWM	Increment Word in Memory by 1	70
JAB	Jump if A Equal B	16
JAN	Jump if A Negative	14
JAX	Jump if A Equal X	17
JAZ	Jump if A Equal Zero	11
JBZ	Jump if B Equal Zero	12
JMP	Jump	60
JOV	Jump if Overflow Set	10
JXN	Jump if X Negative	15
JXZ	Jump if X Equal Zero	13
LDA	Load A	E0
LDV	Load Variable	E8
LDX	Load X	80
LLA	Logical Left A	20
LLB	Logical Left B	21
LLL	Logical Left Long	22
LRA	Logical Right A	24
LRB	Logical Right B	25
LRL	Logical Right Long	26
MUL	Multiply	90
NAB	Jump if A Not Equal B	1E
NAN	Jump if A Not Negative	1C
NAX	Jump if A Not Equal X	1F
NAZ	Jump if A Not Equal Zero	19
NBZ	Jump if B Not Equal Zero	1A
NOP	No Operation	34
NOV	Jump if Overflow Not Set	18
NXN	Jump if X Not Negative	1D
NXZ	Jump if X Not Zero	1B
OBA	Output Byte from A	39
OBB	Output Byte from B	3A

Operation Code	Definition	Hexadecimal Operation Code
OBM	Output Byte from Memory	3B
OBS	Output Byte Serially	38
OCA	One's Complement A	4A
OCB	One's Complement B	4B
ORA	Or B with A result in A	40
ORB	Or A with B result in B	42
PMP	Protect Memory Page	03
RO1	Reset Overflow and Set Word Length to 1	08
RO2	Reset Overflow and Set Word Length to 2	09
RO3	Reset Overflow and Set Word Length to 3	0A
RO4	Reset Overflow and Set Word Length to 4	0B
RTJ	Return Jump	68
SBA	Subtract from A	B0
SBV	Subtract from B	B8
SO1	Set Overflow and Set Word Length to 1	0C
SO2	Set Overflow and Set Word Length to 2	0D
SO3	Set Overflow and Set Word Length to 3	0E
SO4	Set Overflow and Set Word Length to 4	0F
STA	Store A	F0
STV	Store Variable	F8
STX	Store X	88
SWX	Subtract Word Length from X	47
TAX	Transfer A to X	4C
TBX	Transfer B to X	4D
TRP	Trap	01
TXA	Transfer X to A	4E
TXB	Transfer X to B	4F
XRA	Exclusive—Or B with A	41
XRB	Exclusive—Or A with B	43

ADDRESSING MODES

Mode Number	Definition	Symbol
0	Direct Page 0	Space
1	Direct Relative	Space
2	Indirect Page 0	*
3	Indirect Relative	*
4	Indexed	—
5	Indexed with Bias	+
6	X=0 Extended Address	/
	X=1 Extended Address Indexed	/
7	Literal	=
	X=0 Indirect Extended Address (Jump and Return Only)	=
	X=1 Indirect Extended Address Indexed (Jump and Return Only)	=

FUNCTIONAL INSTRUCTION SET

Operation Code	Mnemonic	Instruction Name	Operation Code	Mnemonic	Instruction Name
Control			Register Operate		
00	HLT	Halt	40	ORA	OR B with A
01	TRP	Trap	41	XRA	Exclusive — OR B with A
02	ESW	Enter Sense Switches	42	ORB	OR A with B
03	PMP	Protect Memory Page	43	XRB	Exclusive — OR A with B
04	DIN	Disable Interrupt System	44	INX	Increment X
05	EIN	Enable Interrupt System	45	DCX	Decrement X
06	DRT	Disable Real Time Clock	46	AWX	Add Word Length to X
07	ERT	Enable Real Time Clock	47	SWX	Subtract Word Length from X
08	RO1	Reset Overflow and Set Word Length to 1	48	INA	Increment A
09	RO2	Reset Overflow and Set Word Length to 2	49	INB	Increment B
0A	RO3	Reset Overflow and Set Word Length to 3	4A	OCA	One's Complement A
0B	RO4	Reset Overflow and Set Word Length to 4	4B	OCB	One's Complement B
0C	SO1	Set Overflow and Set Word Length to 1	4C	TAX	Transfer A to X
0D	SO2	Set Overflow and Set Word Length to 2	4D	TBX	Transfer B to X
0E	SO3	Set Overflow and Set Word Length to 3	4E	TXA	Transfer X to A
0F	SO4	Set Overflow and Set Word Length to 4	4F	TXB	Transfer X to B
Conditional Jump			Memory Referencing Instruction		
10	JOV	Jump if Overflow Set	Fixed Word Length		
11	JAZ	Jump if A Equal to Zero	60	JMP	Jump
12	JBZ	Jump if B Equal to Zero	68	RTJ	Return Jump
13	JXZ	Jump if X Equal to Zero	70	IWM	Increment Word in Memory
14	JAN	Jump if A Negative	78	DWM	Decrement Word in Memory
15	JXN	Jump if X Negative	80	LDX	Load X
16	JAB	Jump if A Equals B	88	STX	Store X
17	JAX	Jump if A Equals X	90	MUL	Multiply
18	NOV	Jump if Overflow not Set	98	DIV	Divide
19	NAZ	Jump if A not Equal to Zero	Variable Word Length		
1A	NBZ	Jump if B not Equal to Zero	A0	ADA	Add to A
1B	NXZ	Jump if X not Equal to Zero	A8	ADV(1 Byte)	Add Variable
1C	NAN	Jump if A not Negative		(2 Bytes)	
1D	NXN	Jump if X not Negative		(3 Bytes)	
1E	NAB	Jump if A not Equal to B		(4 Bytes)	
1F	NAX	Jump if A not Equal to X	B0	SBA	Subtract from A
Shift			B8	SBV(1 Byte)	Subtract Variable
20	LLA	Logical Left A		(2 Bytes)	
21	LLB	Logical Left B		(3 Bytes)	
22	LLL	Logical Left Long		(4 Bytes)	
24	LRA	Logical Right A	C0	CPA	Compare A
25	LRB	Logical Right B	C8	CPV(1 Byte)	Compare Variable
26	LRL	Logical Right Long		(2 Bytes)	
28	ALA	Arithmetic Left A		(3 Bytes)	
29	ALB	Arithmetic Left B		(4 Bytes)	
2A	ALL	Arithmetic Left Long	D0	ANA	And A
2C	ARA	Arithmetic Right A	D8	ANV(1 Byte)	And Variable
2D	ARB	Arithmetic Right B		(2 Bytes)	
2E	ARL	Arithmetic Right Long		(3 Bytes)	
Input/Output				(4 Bytes)	
30	IBS	Input Byte Serially	E0	LDA	Load A
31	IBA	Input Byte to A	E8	LDV(1 Byte)	Load Variable
32	IBB	Input Byte to B		(2 Bytes)	
33	IBM	Input Byte to Memory		(3 Bytes)	
34	NOP			(4 Bytes)	
38	OBS	Output Byte Serially	F0	STA	Store A
39	OBA	Output Byte from A	F8	STV(1 Byte)	Store Variable
3A	OB B	Output Byte from B		(2 Bytes)	
3B	OBM	Output Byte from Memory		(3 Bytes)	
				(4 Bytes)	

STANDARD CHARACTER CODES

SYMBOL	ASCII (HEX)	EBCDIC (HEX)	EBCDIC (PUNCH CODE)	SYMBOL	ASCII (HEX)	EBCDIC (HEX)	EBCDIC (PUNCH CODE)
blank	A0	40	blank	@	C0	7C	8-4
!	A1	5A	11-8-2	A	C1	C1	12-1
"	A2	7F	8-7	B	C2	C2	12-2
#	A3	7B	8-3	C	C3	C3	12-3
\$	A4	5B	11-8-3	D	C4	C4	12-4
%	A5	6C	0-8-4	E	C5	C5	12-5
&	A6	50	12	F	C6	C6	12-6
'	A7	7D	8-5	G	C7	C7	12-7
(	A8	4D	12-8-5	H	C8	C8	12-8
)	A9	5D	11-8-5	I	C9	C9	12-9
*	AA	5C	11-8-4	J	CA	D1	11-1
+	AB	4E	12-8-6	K	CB	D2	11-2
,	AC	6B	0-8-3	L	CC	D3	11-3
-	AD	60	11	M	CD	D4	11-4
.	AE	4B	12-8-3	N	CE	D5	11-5
/	AF	61	0-1	O	CF	D6	11-6
0	B0	F0	0	P	D0	D7	11-7
1	B1	F1	1	Q	D1	D8	11-8
2	B2	F2	2	R	D2	D9	11-9
3	B3	F3	3	S	D3	E2	0-2
4	B4	F4	4	T	D4	E3	0-3
5	B5	F5	5	U	D5	E4	0-4
6	B6	F6	6	V	D6	E5	0-5
7	B7	F7	7	W	D7	E6	0-6
8	B8	F8	8	X	D8	E7	0-7
9	B9	F9	9	Y	D9	E8	0-8
:	BA	7A	8-2	Z	DA	E9	0-9
;	BB	5E	11-8-6	[	DB	4F	12-8-7
<	BC	4C	12-8-4	\	DC	4A	12-8-2
=	BD	7E	8-6	]	DD	5F	11-8-7
>	BE	6E	0-8-6	↑	DE	6D	0-8-5
?	BF	6F	0-8-7	←	DF	6A	0-8-2

TELETYPE CONTROL AND TRANSMISSION CODES

FUNCTION	ASCII
NULL	80
SOM (Print on)	81
EAO	82
EOM	83
EOT (Print off)	84
WRU	85
RU	86
BELL	87
FEO	88
H. TAB	89
LINE FEED	8A
V. TAB	8B
FORM	8C
CARRIAGE RETURN	8D
SO	8E
SI	8F
DCO	90
X-ON (Reader on)	91
TAPE (Punch on)	92
X-OFF (Reader off)	93
TAPE OFF (Punch off)	94
ERROR	95
SYNC	96
LEM	97
S0	98
S1	99
S2	9A
S3	9B
S4	9C
S5	9D
S6	9E
S7	9F

ASSEMBLER ERRORS

Error Code	Definition
A	Address Error
M	Multidefined Symbol Error
N	Name Field Error
O	Operation Mnemonic Error
R	Range Error
U	Undefined Symbol Error

CONSTANT IDENTIFIERS

Identifier	Definition
H	Half Word Integer
F	Full Word Integer
E	Extended Integer
D	Double Word Integer
A	Address Constant
X	Hexadecimal Literal
C	Character Literal
	Decimal Constants have no Identifiers

PSEUDO OPERATIONS

Operators	Definitions
DC	Defines Constants
DS	Reserve Areas of Memory
EJECT	Prints Next Instruction on Top of Page
END	Terminates Assembly
EQU	Assign a Name the Value of an Existing Operand
IDENT	Identifies Start of Program
ORG	Set Instruction Location Counter
SET	Same as EQU but will not cause Multi-Defined Error
SPACE	Skips Number of Operand Lines
	If extends past page next prints instruction on top of page

INPUT/OUTPUT STATUS BITS

PARALLEL TELETYPE

(Device address: 00)

Bit	Value	Condition
7	0	Not Used for Status Information
6	0	Not Used for Status Information
5	0	Not Used for Status Information
4	0	Not Used for Status Information
3	0	No Error Detected
	1	Lost Data Detected
2	0	Write Buffer Not Ready
	1	Write Buffer Ready for Transfer from Computer
1	0	Read Buffer Not Ready
	1	Read Buffer Ready for Transfer to Computer
0	0	Concurrent Mode
	1	Not in Concurrent Mode

300 LPS PAPER TAPE READER

(Device address: 02)

Bit	Value	Condition
7	0	Device is Operational
	1	Device is Not Operational
6	0	Not Used for Status Information
5	0	Not Used for Status Information
4	0	Not Used for Status Information
3	0	No Error
	1	Data Input Transfer Error
2	0	Not Used for Status Information
1	0	Data Not Ready for Input Transfer
	1	Data Is Ready for Input Transfer
0	0	Device Not in Concurrent Mode
	1	Device In Concurrent Mode

DRPE PAPER TAPE PUNCH

(Device address: 03)

Bit	Value	Condition
7	0	Not Used for Status Information
6	0	Tape Supply Greater Than 250 Feet
	1	Tape Supply Low — Less Than 250 Feet
5	0	Punch Operating in Serial Mode
	1	Punch Operating in Concurrent Mode
4	0	Tape Supply OK
	1	Tape Supply Exhausted
3	0	No Device Errors
	1	Punch or Feed Error Detected
2	0	Punch Busy — Not Ready
	1	Punch Ready — Not Busy
1	0	Not Used for Status Information
0	0	Power Not Ready
	1	Power Is Ready

400 CPM CARD READER

(Device address: 04)

Bit	Value	Condition
7	0	Not Used for Status Information
6	0	Not Used for Status Information
5	0	Not Used for Status Information
4	0	No Electro — Mechanical Failure
	1	Electro — Mechanical Failure Detected
3	0	No Ebcidc Error
	1	Ebcidc Error Detected
2	0	Hopper and Stacker at Satisfactory Levels
	1	Hopper Empty or Stacker Full
1	0	Character Not Ready for Input Transfer
	1	Character Is Ready for Input Transfer
0	0	Card Reader Busy — Not Ready for Operation
	1	Card Reader Ready for Operation

300 LPM LINE PRINTER

(Device address: 05)

Bit	Value	Condition
7	0	Printer Not at Top of Form
	1	Printer Is at Top of Form
6	0	Not Used for Status Information
5	0	Device Not in Concurrent Mode
	1	Device In Concurrent Mode
4	0	Not Used for Status Information
3	0	No Device Error
	1	Device Error Detected — Print, Form Check, Alarm
2	0	Operation Not Complete — Not Ready to Receive
	1	Operation Is Complete — Ready to Receive Another Character
1	0	Not Used for Status Information
0	0	Device Not Ready
	1	Device Ready for Operation

CASSETTE TAPE TRANSPORT

(Device address: 09, 0A, 0B, 0C)

Bit	Value	Condition
7	1	Track protect violated
	0	Not violated
6	1	No change of tape address
	0	Tape address change
5	1	Transport not stalled
	0	Transport stalled
4	1	Not beginning or end of tape
	0	Beginning or end of tape
3	1	Character not in error
	0	Character in error
2	1	Concurrent output
	0	Not concurrent output
1	1	Concurrent input
	0	No concurrent input
0	1	Data ready
	0	Data not ready